CLAIMS

1. A method of decoding video data, the method comprising:

determining that a block of video data is encoded without transforming residual data for the block;

determining a quantization parameter for the block of video data;

based on the determined quantization parameter, determining a range for levels of quantized residual values of the block of video data, wherein the range goes from zero to a maximum possible level for the levels of quantized residual values of the block of video data;

dividing the range into k intervals, wherein k is an integer value, each interval includes multiple levels for quantized residual values, and each interval has an associated index value between 0 and k-1;

determining a level for a quantized residual value of the block of video data based on the k intervals, wherein determining the level for the quantized residual value of the block of video data based on the k intervals comprises:

receiving information indicating an index corresponding to a particular interval of the k intervals within which the level for the quantized residual value falls;

receiving information indicating a difference value, wherein the difference value represents a difference between a reference level value for the particular interval and the level for the quantized residual value of the block of video data; and

based on the reference level value and the difference value, determining the level for the quantized residual value; and

outputting decoded video data based on the level for the quantized residual value.

2. The method of claim 1, further comprising:

dequantizing the level for the quantized residual value to determine a level for a dequantized residual value;

receiving a syntax element indicating a sign for the dequantized residual value; and

based on the level for the dequantized residual value and the sign for the dequantized residual value, determining the dequantized residual value.

3. The method of claim 2, further comprising:

determining a residual block for the block of video data, wherein the residual block comprises the dequantized residual value;

adding the residual block to a prediction block for the block of video data to determine a reconstructed block for the block of video data;

generating a picture of decoded video data based on the reconstructed block; and

outputting the picture of decoded video data.

4. The method of claim 1, wherein a first interval of the k intervals includes values ranging from 1 to a first threshold, the method further comprising:

receiving a syntax element indicating that the level for the quantized residual value is greater than zero.

5. The method of claim 1, wherein a first interval of the k intervals includes values ranging from 2 to a first threshold, the method further comprising:

receiving a syntax element indicating that the level for the quantized residual value is greater than zero;

receiving a syntax element indicating that the level for the quantized residual value is greater than one.

6. The method of claim 1, further comprising:

for a first interval of the k intervals, receiving a syntax element indicating that the level for the quantized residual value is greater than values included in the first interval;

for a second interval of the k intervals, receiving a syntax element indicating that the level for the quantized residual value is included in the second interval;

wherein the syntax element indicating the difference value indicates a difference between a reference level value for the second interval and the level for the quantized residual value of the block of video data.

7. The method of claim 1, further comprising:

receiving, for respective intervals of the k intervals, flags indicating that the level for the quantized residual value is greater than values included in the respective intervals for the flags until receiving a flag indicating the level for the quantized residual value is within an interval associated with the flag.

8. The method of claim 1, wherein the k intervals include an interval ranging from 0 to a first threshold, an interval ranging from the first threshold plus 1 to a second threshold, and an interval ranging from the second threshold plus 1 to a third threshold, the method further comprising:

determining the first threshold, the second threshold, and the third threshold based on the quantization parameter.

9. The method of claim 1, wherein the k intervals include an interval ranging from 1 to a first threshold, an interval ranging from the first threshold plus 1 to a second threshold, and an interval ranging from the second threshold plus 1 to a third threshold, the method further comprising:

determining the first threshold, the second threshold, and the third threshold based on the quantization parameter.

10. The method of claim 1, wherein the k intervals include an interval ranging from 2 to a first threshold, an interval ranging from the first threshold plus 1 to a second threshold, and an interval ranging from the second threshold plus 1 to a third threshold, the method further comprising:

determining the first threshold, the second threshold, and the third threshold based on the quantization parameter.

11. The method of claim 10, wherein the k intervals include an interval ranging from the third threshold plus 1 to the maximum possible level for the levels of quantized residual values of the block of video data.

12. The method of claim 1, wherein the k intervals include the following intervals:

$[2, t_1]$, $[t_1+1, t_2]$, $[t_2+1, t_3]$, … $[t_{k-2}+1, t_{k-1}]$, $[t_{k-1}+1, \text{maxTsLevel}]$, wherein maxTsLevel represents the maximum possible level for the levels of quantized residual values of the block of video data based on the quantization parameter for the block of video data, and wherein t_n represents an upper threshold for the n-th interval, wherein n ranges from 0 to k-1.

13. The method of claim 1, further comprising:

bypass decoding the syntax element indicating the difference value.

14. A method of generating a bitstream of encoded video data, the method comprising:

determining that a block of video data is encoded without transforming residual data for the block;

determining a level for a quantized residual value of the block of video data;

determining a quantization parameter for the block of video data;

based on the determined quantization parameter, determining a range for levels of quantized residual values of the block of video data, wherein the range goes from zero to a maximum possible level for the levels of quantized residual values of the block of video data;

dividing the range into k intervals, wherein k is an integer value, each interval includes multiple levels for quantized residual values, and each interval has an associated index value between 0 and k-1;

determining a particular interval of the k intervals that includes the level for the quantized residual value;

determining a difference value, wherein the difference value represents a difference between a reference level value for the particular interval and the level for the quantized residual value of the block of video data; and

signaling the level for the quantized residual value of the block of video data based on the k intervals, wherein signaling the level for the quantized residual value of the block of video data based on the k intervals comprises:

generating, for inclusion in the bitstream of encoded video data, one or more syntax elements indicating an associated index value of the particular interval;

generating, for inclusion in the bitstream of encoded video data, a syntax element indicating the difference value; and

outputting the bitstream of encoded video data.

15. The method of claim 14, wherein determining the level for the quantized residual value of the block of video data comprises:

determining a level for a residual value; and

quantizing the level for the residual value to determine the level for the quantized residual value.

16. The method of claim 15, further comprising:

generating, for inclusion in the bitstream of encoded video data, a syntax element indicating a sign for the residual value.

17. The method of claim 14, wherein a first interval of the k intervals includes values ranging from 1 to a first threshold, the method further comprising:

generating, for inclusion in the bitstream of encoded video data, a syntax element indicating that the level of the quantized residual value is greater than zero.

18. The method of claim 14, wherein a first interval of the k intervals includes values ranging from 2 to a first threshold, the method further comprising:

generating, for inclusion in the bitstream of encoded video data, a syntax element indicating that the level for the quantized residual value is greater than zero;

generating, for inclusion in the bitstream of encoded video data, a syntax element indicating that the level for the quantized residual value is greater than one.

19. The method of claim 14, further comprising:

for a first interval of the k intervals, generating, for inclusion in the bitstream of encoded video data, a syntax element indicating that the level for the quantized residual value is greater than values included in the first interval;

for a second interval of the k intervals, generating, for inclusion in the bitstream of encoded video data, a syntax element indicating that the level for the quantized residual value is included in the second interval;

wherein the syntax element indicating the difference value indicates a difference between a reference level value for the second interval and the level for the quantized residual value of the block of video data.

20. The method of claim 14, further comprising:

generating, for inclusion in the bitstream of encoded video data, for respective intervals of the k intervals, flags indicating that the level for the quantized residual value is greater than values included in the respective intervals for the flags until generating, for inclusion in the bitstream of encoded video data, a flag indicating the level for the quantized residual value is within an interval associated with the flag.

21. The method of claim 14, wherein the k intervals include an interval ranging from 0 to a first threshold, an interval ranging from the first threshold plus 1 to a second threshold, and an interval ranging from the second threshold plus 1 to a third threshold, the method further comprising:

determining the first threshold, the second threshold, and the third threshold based on the quantization parameter.

22. The method of claim 14, wherein the k intervals include an interval ranging from 1 to a first threshold, an interval ranging from the first threshold plus 1 to a second threshold, and an interval ranging from the second threshold plus 1 to a third threshold, the method further comprising:

determining the first threshold, the second threshold, and the third threshold based on the quantization parameter.

23. The method of claim 14, wherein the k intervals include an interval ranging from 2 to a first threshold, an interval ranging from the first threshold plus 1 to a second threshold, and an

interval ranging from the second threshold plus 1 to a third threshold, the method further comprising:

determining the first threshold, the second threshold, and the third threshold based on the quantization parameter.

24. The method of claim 23, wherein the k intervals include an interval ranging from the third threshold plus 1 to the maximum possible level for the levels of quantized residual values of the block of video data.

25. The method of claim 14, wherein the k intervals include the following intervals:

$[2, t_1]$, $[t_1+1, t_2]$, $[t_2+1, t_3]$, … $[t_{k-2}+1, t_{k-1}]$, $[t_{k-1}+1$, maxTsLevel], wherein maxTsLevel represents the maximum possible level for the levels of quantized residual values of the block of video data based on the quantization parameter for the block of video data, and wherein t_n represents an upper threshold for the n-th interval, wherein n ranges from 0 to k-1.

26. The method of claim 14, further comprising:

bypass encoding the syntax element indicating the difference value.

27. A device for decoding video data, the device comprising:

a memory configured to store video data; and

one or more processors configured to:

determine that a block of video data is encoded without transforming residual data for the block;

determine a quantization parameter for the block of video data;

based on the determined quantization parameter, determine a range for levels of quantized residual values of the block of video data, wherein the range goes from zero to a maximum possible level for the levels of quantized residual values of the block of video data;

divide the range into k intervals, wherein k is an integer value, each interval includes multiple levels for quantized residual values, and each interval has an associated index value between 0 and k-1;

determine a level for a quantized residual value of the block of video data based on the k intervals, wherein to determine the level for the quantized residual value of the block of video data based on the k intervals, the one or more processors are further configured to:

receive information indicating an index corresponding to a particular interval of the k intervals within which the level for the quantized residual value falls;

receive information indicating a difference value, wherein the difference value represents a difference between a reference level value for the particular interval and the level for the quantized residual value of the block of video data; and

based on the reference level value and the difference value, determine the level for the quantized residual value; and

output decoded video data based on the level for the quantized residual value.

28. The device of claim 27, wherein the one or more processors are further configured to:

dequantize the level for the quantized residual value to determine a level for a dequantized residual value;

receive a syntax element indicating a sign for the dequantized residual value; and

based on the level for the dequantized residual value and the sign for the dequantized residual value, determine the dequantized residual value.

29. The device of claim 28, wherein the one or more processors are further configured to:

determine a residual block for the block of video data, wherein the residual block comprises the dequantized residual value;

add the residual block to a prediction block for the block of video data to determine a reconstructed block for the block of video data;

generate a picture of decoded video data based on the reconstructed block; and

output the picture of decoded video data.

30. The device of claim 27, wherein a first interval of the k intervals includes values ranging from 1 to a first threshold, wherein the one or more processors are further configured to:

receive a syntax element indicating that the level for the quantized residual value is greater than zero.

31. The device of claim 27, wherein a first interval of the k intervals includes values ranging from 2 to a first threshold, wherein the one or more processors are further configured to:

receive a syntax element indicating that the level for the quantized residual value is greater than zero;

receive a syntax element indicating that the level for the quantized residual value is greater than one.

32. The device of claim 27, wherein the one or more processors are further configured to:

for a first interval of the k intervals, receive a syntax element indicating that the level for the quantized residual value is greater than values included in the first interval;

for a second interval of the k intervals, receive a syntax element indicating that the level for the quantized residual value is included in the second interval;

wherein the syntax element indicating the difference value indicates a difference between a reference level value for the second interval and the level for the quantized residual value of the block of video data.

33. The device of claim 27, wherein the one or more processors are further configured to:

receive, for respective intervals of the k intervals, flags indicating that the level for the quantized residual value is greater than values included in the respective intervals for the flags until receiving a flag indicating the level for the quantized residual value is within an interval associated with the flag.

34. The device of claim 27, wherein the k intervals include an interval ranging from 0 to a first threshold, an interval ranging from the first threshold plus 1 to a second threshold, and an interval ranging from the second threshold plus 1 to a third threshold, wherein the one or more processors are further configured to:

determine the first threshold, the second threshold, and the third threshold based on the quantization parameter.

35. The device of claim 27, wherein the k intervals include an interval ranging from 1 to a first threshold, an interval ranging from the first threshold plus 1 to a second threshold, and an interval ranging from the second threshold plus 1 to a third threshold, wherein the one or more processors are further configured to:

determine the first threshold, the second threshold, and the third threshold based on the quantization parameter.

36. The device of claim 27, wherein the k intervals include an interval ranging from 2 to a first threshold, an interval ranging from the first threshold plus 1 to a second threshold, and an interval ranging from the second threshold plus 1 to a third threshold, wherein the one or more processors are further configured to:

determine the first threshold, the second threshold, and the third threshold based on the quantization parameter.

37. The device of claim 36, wherein the k intervals include an interval ranging from the third threshold plus 1 to the maximum possible level for the levels of quantized residual values of the block of video data.

38. The device of claim 27, wherein the k intervals include the following intervals:

$[2, t_1]$, $[t_1+1, t_2]$, $[t_2+1, t_3]$, … $[t_{k-2}+1, t_{k-1}]$, $[t_{k-1}+1, \text{maxTsLevel}]$, wherein maxTsLevel represents the maximum possible level for the levels of quantized residual values of the block of video data based on the quantization parameter for the block of video data, and wherein t_n represents an upper threshold for the n-th interval, wherein n ranges from 0 to k-1.

39. The device of claim 27, wherein the one or more processors are further configured to:

bypass decode the syntax element indicating the difference value.

40. The device of claim 27, wherein the device comprises a wireless communication device,

further comprising a receiver configured to receive encoded video data and a display configured to display the decoded video data.

41. The device of claim 40, wherein the wireless communication device comprises a telephone handset and wherein the receiver is configured to demodulate, according to a wireless communication standard, a signal comprising the encoded video data.

42. A device for encoding video data, the device comprising:
a memory configured to store video data; and
one or more processors configured to:

determine that a block of video data is encoded without transforming residual data for the block;

determine a level for a quantized residual value of the block of video data;

determine a quantization parameter for the block of video data;

based on the determined quantization parameter, determine a range for levels of quantized residual values of the block of video data, wherein the range goes from zero to a maximum possible level for the levels of quantized residual values of the block of video data;

divide the range into k intervals, wherein k is an integer value, each interval includes multiple levels for quantized residual values, and each interval has an associated index value between 0 and k-1;

determine a particular interval of the k intervals that includes the level for the quantized residual value;

determine a difference value, wherein the difference value represents a difference between a reference level value for the particular interval and the level for the quantized residual value of the block of video data;

signal the level for the quantized residual value of the block of video data based on the k intervals, wherein to signal the level for the quantized residual value of the block of video data based on the k intervals the one or more processors are further configured to:

generate, for inclusion in the bitstream of encoded video data, one or more syntax elements indicating an associated index value of the particular interval;

generate, for inclusion in the bitstream of encoded video data, a syntax element indicating the difference value; and

output the bitstream of encoded video data.

43. The device of claim 42, wherein to determine the level for the quantized residual value of the block of video data, the one or more processors are further configured to:

determine a level for a residual value; and

quantize the level for the residual value to determine the level for the quantized residual value.

44. The device of claim 43, the one or more processors are further configured to:

generate, for inclusion in the bitstream of encoded video data, a syntax element indicating a sign for the residual value.

45. The device of claim 42, wherein a first interval of the k intervals includes values ranging from 1 to a first threshold, wherein the one or more processors are further configured to:

generate, for inclusion in the bitstream of encoded video data, a syntax element indicating that the level of the quantized residual value is greater than zero.

46. The device of claim 42, wherein a first interval of the k intervals includes values ranging from 2 to a first threshold, wherein the one or more processors are further configured to:

generate, for inclusion in the bitstream of encoded video data, a syntax element indicating that the level for the quantized residual value is greater than zero;

generate, for inclusion in the bitstream of encoded video data, a syntax element indicating that the level for the quantized residual value is greater than one.

47. The device of claim 42, wherein the one or more processors are further configured to:

for a first interval of the k intervals, generate, for inclusion in the bitstream of encoded video data, a syntax element indicating that the level for the quantized residual value is greater than values included in the first interval;

for a second interval of the k intervals, generate, for inclusion in the bitstream of encoded video data, a syntax element indicating that the level for the quantized residual value is included in the second interval;

wherein the syntax element indicating the difference value indicates a difference between a reference level value for the second interval and the level for the quantized residual value of the block of video data.

48. The device of claim 42, wherein the one or more processors are further configured to:

generate, for inclusion in the bitstream of encoded video data, for respective intervals of the k intervals, flags indicating that the level for the quantized residual value is greater than values included in the respective intervals for the flags until generating, for inclusion in the bitstream of encoded video data, a flag indicating the level for the quantized residual value is within an interval associated with the flag.

49. The device of claim 42, wherein the k intervals include an interval ranging from 0 to a first threshold, an interval ranging from the first threshold plus 1 to a second threshold, and an interval ranging from the second threshold plus 1 to a third threshold, wherein the one or more processors are further configured to:

determine the first threshold, the second threshold, and the third threshold based on the quantization parameter.

50. The device of claim 42, wherein the k intervals include an interval ranging from 1 to a first threshold, an interval ranging from the first threshold plus 1 to a second threshold, and an interval ranging from the second threshold plus 1 to a third threshold, wherein the one or more processors are further configured to:

determine the first threshold, the second threshold, and the third threshold based on the quantization parameter.

51. The device of claim 42, wherein the k intervals include an interval ranging from 2 to a first threshold, an interval ranging from the first threshold plus 1 to a second threshold, and an

interval ranging from the second threshold plus 1 to a third threshold, wherein the one or more processors are further configured to:

determine the first threshold, the second threshold, and the third threshold based on the quantization parameter.

52. The device of claim 51, wherein the k intervals include an interval ranging from the third threshold plus 1 to the maximum possible level for the levels of quantized residual values of the block of video data.

53. The device of claim 42, wherein the k intervals include the following intervals:

$[2, t_1]$, $[t_1+1, t_2]$, $[t_2+1, t_3]$, … $[t_{k-2}+1, t_{k-1}]$, $[t_{k-1}+1$, maxTsLevel], wherein maxTsLevel represents the maximum possible level for the levels of quantized residual values of the block of video data based on the quantization parameter for the block of video data, and wherein t_n represents an upper threshold for the n-th interval, wherein n ranges from 0 to k-1.

54. The device of claim 42, wherein the one or more processors are further configured to:

bypass encode the syntax element indicating the difference value.

55. The device of claim 42, wherein the device comprises a wireless communication device, further comprising a transmitter configured to transmit encoded video data.

56. The device of claim 55, wherein the wireless communication device comprises a telephone handset and wherein the transmitter is configured to modulate, according to a wireless communication standard, a signal comprising the encoded video data.

57. A non-transitory computer readable storage medium storing instructions that when executed by one or more processors cause the one or more processors to

determine that a block of video data is encoded without transforming residual data for the block;

determine a quantization parameter for the block of video data;

based on the determined quantization parameter, determine a range for levels of quantized residual values of the block of video data, wherein the range goes from zero to a maximum possible level for the levels of quantized residual values of the block of video data;

divide the range into k intervals, wherein k is an integer value, each interval includes multiple levels for quantized residual values, and each interval has an associated index value between 0 and k-1;

determine a level for a quantized residual value of the block of video data based on the k intervals, wherein to determine the level for the quantized residual value of the block of video data based on the k intervals, the instructions cause the one or more processors to:

receive information indicating an index corresponding to a particular interval of the k intervals within which the level for the quantized residual value falls;

receive information indicating a difference value, wherein the difference value represents a difference between a reference level value for the particular interval and the level for the quantized residual value of the block of video data; and

based on the reference level value and the difference value, determine the level for the quantized residual value; and

output decoded video data based on the level for the quantized residual value.

58. An apparatus for decoding video data, the apparatus comprising:

means for determining that a block of video data is encoded without transforming residual data for the block;

means for determining a quantization parameter for the block of video data;

means for determining a range for levels of quantized residual values of the block of video data based on the determined quantization parameter, wherein the range goes from zero to a maximum possible level for the levels of quantized residual values of the block of video data;

means for dividing the range into k intervals, wherein k is an integer value, each interval includes multiple levels for quantized residual values, and each interval has an associated index value between 0 and k-1;

means for determining a level for a quantized residual value of the block of video data based on the k intervals, wherein the means for determining the level for the quantized residual value of the block of video data based on the k intervals comprises:

means for receiving information indicating an index corresponding to a particular interval of the k intervals within which the level for the quantized residual value falls;

means for receiving information indicating a difference value, wherein the difference value represents a difference between a reference level value for the particular interval and the level for the quantized residual value of the block of video data; and

means for determining the level for the quantized residual value based on the reference level value and the difference value; and

means for outputting decoded video data based on the level for the quantized residual value.

59. The method of claim 1, wherein the k intervals include the following intervals:

$[X, t_1]$, $[t_1+1, t_2]$ … $[t_{k-2}+1, t_{k-1}]$, $[t_{k-1}+1, maxTsLevel]$, wherein X represents a minimum value for interval k=0, wherein maxTsLevel represents the maximum possible level for the levels of quantized residual values of the block of video data based on the quantization parameter for the block of video data, and wherein t_n represents an upper threshold for the n-th interval, wherein n ranges from 0 to k-1.

60. The device of claim 27, wherein the k intervals include the following intervals:

$[X, t_1]$, $[t_1+1, t_2]$ … $[t_{k-2}+1, t_{k-1}]$, $[t_{k-1}+1, maxTsLevel]$, wherein X represents a minimum value for interval k=0, wherein maxTsLevel represents the maximum possible level for the levels of quantized residual values of the block of video data based on the quantization parameter for the block of video data, and wherein t_n represents an upper threshold for the n-th interval, wherein n ranges from 0 to k-1.